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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/664,781	09/16/2003	Christophe Maleville	4717-6100	4844

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WINSTON & STRAWN LLP  
1700 K STREET, N.W.  
WASHINGTON, DC 20006

EXAMINER
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CARRILLO, BIBI SHARIDAN

ART UNIT	PAPER NUMBER
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1746

DATE MAILED: 04/12/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/664,781

Applicant(s)

MALEVILLE ET AL.

Examiner

Sharidan Carrillo

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 08 February 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-5 and 11-28 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-5 and 11-28 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 112*

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-5 and 16-28 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 is indefinite because it is unclear whether the etching with ozone is performed within the closed container as well. Additionally, it is unclear the structural relationship between the bath and the closed container. It is unclear whether the bath is considered the closed container or whether the bath is closed container different from the closed container recited in the preamble, or whether the bath is positioned within the closed container. Claim 16 is indefinite because it is unclear the bonding step occurs within the closed container as well. Claim 25 is indefinite for similar reasons set forth with respect to claim 1. Claim 25 is indefinite for similar reasons as set forth in claim 1. It is unclear the structural relationship between the bath and the closed container.

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

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4. Claims 1-2, 5, 11, and 25-26 are rejected under 35 U.S.C. 102(e) as being anticipated by Hishiya et al. (US2004/0087180).

Hishiya et al. teach pretreating a silicon wafer by immersion in an HF solution followed by transferring the wafer within a closed container and treating a gaseous ozone atmosphere (Fig. 2-3, paragraphs 70, 118, 131-137). Paragraph 118 teaches that the oxidation can be performed using a dry oxidation method comprising ozone. In reference to claims 5 and 11, refer to paragraph 131. The limitations of an hydrophobic and hydrophilic surface and uniformly saturating the substrate surface with oxygen, as recited in claims 1 and 26, are inherently met as a result of performing the same method steps as that of the instantly claimed invention. In reference to performing the method steps in a single container, refer to paragraph 0129.

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hishiya et al. (US2004/0087180).

Hishiya et al. fail to teach the duration of wet chemical etching. However, it would have been within the level of the skilled artisan to modify the duration of the cleaning depending upon the amount and type of contaminants present on the wafer surface.

7. Claims 13-16, 20-23 and 27-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hishiya et al. (US2004/0087180), as applied to claims 1-2, 5, 11, and 25-26 in paragraph 4 above, and further in view of Geusic et al. (6630713).

In reference to claims 13-16 and 21-22, Hishiya et al. fail to teach bonding the etched surface and annealing at a temperature of 500 degrees centigrade. Geusic teaches a method of bonding one semiconductor surface to a second semiconductor surface. In col. 4, lines 20-30, Geusic teaches it is convention to anneal surfaces at a temperature of at least about 500 degrees centigrade. In col. 5, lines 20-60, Geusic

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teaches etching the wafer surface with HF solution and further teaches bonding the wafer prior to annealing in order to retain cleanliness of wafer surfaces. It would have been obvious to a person of ordinary skill in the art to have modified the method of Hishiya et al. to include bonding and annealing since such steps, as taught by Geusic are conventional in the semiconductor manufacturing process. Additionally, applicant's own specification (page 6) teaches that the limitations of laying one wafer on top of another and applying pressure are conventional steps used in wafer bonding. In reference to bond strength, one of ordinary skill in the art would reasonably expect the annealing to increase the bond strength to between 0.28 to 0.38 since Geusic is performing annealing at the same temperature as that of the instantly claimed invention. In reference to claim 20, it would have been obvious to a skilled artisan to treat another substrate by wet etchings in order to remove contaminants from the substrate surface prior to bonding. In reference to claim 23, refer to the teachings of Hishiya et al. In reference to claim 27, Hishiya in view of Geusic fails to teach exposing the substrate with gaseous ozone to saturate the surface with silanol groups. However, a skilled artisan would have reasonably expected silanol sites to be formed since Hishiya is performing the same method steps as the instantly claimed invention. With respect to bonding the surface to another surface containing silanol sites, Geusic et al. teach bonding of the wafers together by Si-Si bonds (col. 7, lines 30-35).

8. Claims 1-5, 11-12, and 25-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wu et al. (US2003/0087532) in view Hishiya et al. (US2004/0087180).

Wu et al. teach etching and oxidizing a semiconductor substrate. In reference to Claims 1 and 11 refer to paragraphs 13 and 44. The limitations of a hydrophobic surface and hydrophilic surface are inherently met as a result of performing the same method steps as that of the instantly claimed invention. In reference to claims 2-3, refer to paragraphs 12 and 37. In reference to claims 4-5 refer to paragraph 57. In reference to claims 12 refer to paragraphs 28 and 29.

In reference to claims 1, 11, and 25, Wu et al. fail to teach immersing the work piece in a closed container. Hishiya teach immersing a substrate with HF to remove oxide followed by oxidation with gaseous ozone. Additionally, paragraph 129 of Hishiya teaches performing multiple process steps using a single container. It would have been obvious and well within the level of the skilled artisan to modify the method of Wu et al. to include immersion, as taught by Hishiya as conventional means for cleaning the substrate surface. In reference to the limitation of a "closed container", Wu teaches the advantages of performing multiple process steps using a single process chamber, as described in paragraphs 10, 11, and 54. In paragraphs 49 and 54, Wu teaches that the equipment used to carry out the methodology in a single process chamber can be found in Patents 5634978 and 5772784, which teach a single closed container. It would have been well within the level of the skilled artisan to have modified the method of Wu et al. to include a "single closed container" since Wu teaches various advantages including a reduction in cycle time, reduction in station to station transfer, step reduction resulting in increased productivity and the added economical advantages of using less chemicals

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during processing. In reference to claim 26, both Wu et al. and Hishiya teaches treating the substrate with gaseous ozone.

9. Claims 13-24 and 27-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wu et al. (US2003/0087532) in view Hishiya et al. (US2004/0087180), as applied to claims 1-5, 11-12, and 25-26 as described in paragraph 8 above, and further in view of Geusic et al. (6630713).

In reference to claims 13-16 and 21-22, Wu et al. in view of Hishiya et al. fail to teach bonding the etched surface and annealing at a temperature of 500 degrees centigrade. Geusic teaches a method of bonding one semiconductor surface to a second semiconductor surface. In col. 4, lines 20-30, Geusic teaches it is convention to anneal surfaces at a temperature of at least about 500 degrees centigrade. In col. 5, lines 20-60, Geusic teaches etching the wafer surface with HF solution and further teaches bonding the wafer prior to annealing in order to retain cleanliness of wafer surfaces. It would have been obvious to a person of ordinary skill in the art to have modified the method of Wu et al. to include bonding and annealing since such steps, as taught by Geusic are conventional in the semiconductor manufacturing process. Additionally, applicant's own specification (page 6) teaches that the limitations of laying one wafer on top of another and applying pressure are conventional steps used in wafer bonding. In reference to bond strength, one of ordinary skill in the art would reasonably expect the annealing to increase the bond strength to between 0.28 to 0.38 since Geusic is performing annealing at the same temperature as that of the instantly claimed invention. In reference to claim 20, it would have been obvious to a skilled artisan to



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treat another substrate by wet etchings in order to remove contaminants from the substrate surface prior to bonding. In reference to claims 17 and 18-19 refer to paragraphs 37 and 57 of Wu et al. In reference to claim 20, it would have been obvious to a skilled artisan to treat another substrate by wet etchings in order to remove contaminants from the substrate surface prior to bonding. In reference to claim 23, refer to the teachings of Hishiya et al. In reference to claims 23-24, refer to paragraphs 28-29 of Wu et al. In reference to claim 27, Wu in view of Hishiya and Geusic fails to teach exposing the substrate with gaseous ozone to saturate the surface with silanol groups. However, a skilled artisan would have reasonably expected silanol sites to be formed since Hishiya is performing the same method steps as the instantly claimed invention. With respect to bonding the surface to another surface containing silanol sites, Geusic et al. teach bonding of the wafers together by Si-Si bonds (col. 7, lines 30-35).

### ***Response to Arguments***

10. The rejection of the claims under 112, second paragraph issues is maintained for the reasons set forth above.

11. Applicant argues that Hishiya is not concerned with providing a dry hydrophilic surface for bonding with another substrate. Applicant further argues that Hishiya does not teach treatment with HF followed directly by ozone treatment. Applicant's arguments are unpersuasive because the limitations of forming a dry hydrophilic surface are inherently met since Hishiya is performing the same method steps as the instantly claimed invention. Applicant's arguments are unpersuasive since Fig. 2 teaches a pre-

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cleaning process directly followed by a pre-treatment process, wherein the pretreatment process includes ozone treatment. Therefore, the limitations of claim 25 are met by the teachings of the prior art as well. Additionally, applicant's claim 1 recites "comprising" which is open-ended to include additional process steps.

12. Applicant argues that Hishiya fails to teach a single container. Applicant's arguments are unpersuasive because paragraph 129 of Hishiya states that each process, including the pre-cleaning process, is performed within the oxidation treatment apparatus of Fig. 1.

13. Applicant argues the benefit of performing the claimed invention using a single container. The use of a single container to perform multiple process steps is notoriously well known in the art, as evidenced by Wu et al. Wu, as previously discussed above, teaches using a single container to reduce cycle time, reduce station to station transfer, reduce step reduction and therefore increase productivity, and further teaches the economical advantage of using less chemicals.

14. Applicant argues that Geusic fails to teach HF followed by ozone in a single container. The secondary reference of Geusic is relied upon to teach the conventional steps of bonding and annealing.

15. Applicant argues that there is no indication in any of the references that the recited step in a single container could increase the binding strength. Applicant's arguments are unpersuasive since claim 14 does not require the annealing to be performed in the same container as the etching and ozone steps.

16. Applicant argues that Wu fails to teach improving the binding characteristics of the surface. Applicant's arguments are unpersuasive since one would reasonably expect the dry hydrophilic surface to be formed since Wu is performing the same steps as the instantly claimed invention.

17. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, both Wu and Hishiya teach treating the wafer with an etchant followed by ozone.

18. In reference to claims 26-28, refer to the rejections as described above.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

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extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

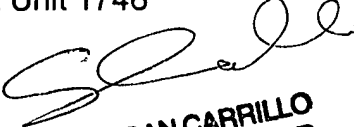
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sharidan Carrillo whose telephone number is 571-272-1297. The examiner can normally be reached on M-W 6:30-4:00pm, alternating Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Barr can be reached on 571-272-1414. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

bsc

Sharidan Carrillo  
Primary Examiner  
Art Unit 1746



SHARIDAN CARRILLO  
PRIMARY EXAMINER